

anal belts of cilia, and a broad ventral band, and becomes a "Telotrochous" larva which passes directly into the adult. The setæ develop from before backwards; and those of the dorsal ramus appear before those of the ventral.

The segmentation is closely similar to that of some Oligochæta (*Euaxes*, *Tubifex*), and resembles also that of the leeches. The gastrula stage is not attained by a typical invagination, but by a downgrowth of the ectoderm over the entoderm.—*Amer. Journ. Sci.* Oct. 1880.

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*The Rhythmical Character of the Process of Segmentation.*

By W. H. BROOKS.

A number of observers have called attention to the fact that in certain animals the segmenting eggs pass through alternating stages, in which the segmentation-products are first conspicuous and well defined and then flattened and fused together.

In a paper on the development of the freshwater pulmonates I have attempted to show that the alternation is due to the fact that periods of segmenting activity alternate with periods of rest, and that the tendency which the elasticity of the egg exerts to render its form spherical when no other force is acting upon it causes the partial obliteration of the outlines of the spherules during each resting stage.

The essential factor is therefore the alternation of rest with activity; and the change of shape during the resting periods is a secondary phenomenon, brought about incidentally by the physical properties of the yolk.

In most eggs the yolk is not sufficiently elastic to allow any great change of form; but careful time-records show that the process of segmentation is rhythmical, and that short periods of active change alternate with longer periods during which there is no external change.

During the past year various members of the Biological Department of the Johns Hopkins University have observed this alternation in various vertebrate and invertebrate eggs. Dr. Clarke has noticed it in an amphibian, *Amblystoma*, where the segmentation is total. I have observed it in the egg of an unknown fish, where segmentation is restricted to a blastoderm. Mr. Wilson has observed it in three annelides, where segmentation is total and irregular—*Arenicola*, *Clymenella*, and *Lumbricus*. It is very well marked in an arthropod, *Leucifer*, whose eggs undergo total regular segmentation.

Its occurrence in so many widely separated groups with such different methods of segmentation renders it probable that it will be found in nearly all eggs upon sufficiently careful examination.—*Amer. Journ. Sci.* Oct. 1880.